EMERGENCY RESPONSE TO NATURAL GAS VEHICLES

STUDENT HANDBOOK

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I. Introduction and Background

Natural gas is the fuel we trust today to heat our homes and cook our food. But natural gas also has a proven safety record as a vehicle fuel. Unlike gasoline, natural gas is nontoxic, non-corrosive, and contains almost no smog-forming hydrocarbons. With its high ignition temperature and narrow explosive range, natural gas is much less likely than gasoline to ignite accidentally.

Natural gas vehicles, or NGVs, offer enduring solutions to the pressing problems of air pollution, ocean and ground water contamination, and global oil supply uncertainty. NGVs meet low emission standards well ahead of state-mandated phase-in schedules. Natural gas has a welldeserved reputation as America's reliable, domestic fuel. With vast proven reserves available in the continental U.S., natural gas is well positioned to serve our transportation energy needs for generations to come.

NGVs are powered by a proven clean and reliable domestic fuel that is available through a rapidly expanding retail infrastructure. With over 80,000 miles of distribution pipeline within California alone, natural gas is already available in most communities. The number of compressed natural gas (CNG) fueling stations has grown in California from a mere handful in 1990 to several hundred today. Across the country there are more than 1,300 fueling stations, with more stations being built each week.

The NGV industry is growing. Over 40 different manufacturers today are producing light, medium and heavy duty vehicles and engines. There are over 109,000 NGVs on U.S. roads and over one and a half million worldwide. Thousands of new vehicles are now being sold annually— typically to fleet vehicle operators. Fleet vehicles include: state and local government, transit, taxi, school, refuse trucks, street sweepers, postal, and freight delivery vehicle operators.

One-third of the states have enacted legislation that offers significant financial incentives for the purchase of an NGV, the purchase of natural gas as a vehicular fuel, or the installation of a natural gas fueling station.The driving cost and range of NGVs compares well to gasoline and diesel vehicles, with fuel efficiency for light duty vehicles of 25 to 30 miles per gallon. Fleets that have switched to NGVs have found their overall operating costs comparable to or lower than conventional vehicles. Natural gas can cost less than other fuels and

burns cleaner, reducing routine maintenance costs and emissions. The use of natural gas reduces U.S. dependence on foreign oil, increasing national security and lowering the foreign trade deficit. Natural gas is an abundant, domestically available product.

Because natural gas is lighter than air, it doesn't pool on the ground as do gasoline, diesel, and propane fuels. The fuel storage cylinders for natural gas are stronger than gasoline tanks and can withstand crash, bonfire, and gun-shot tests.

There are two distinct fuel storage techniques for NGVs: Compressed Natural Gas (CNG) and Liquefied Natural Gas" (LNG). Even though natural gas is a safe and reliable fuel, the two fuel storage techniques warrant different safety precautions and awareness by emergency response personnel.

NGVs are relatively safe compared to other vehicle types on the road, they operate in an environment that, in California alone, had 511,248 traffic collisions in the year 2000. Of these, 3,331 were fatal and 198,348 injury-related, according to the State Wide Integrated Traffic Records System (SWITRS 2000 report). From 1992 to 1999, the California Fire Incident Reporting System (CFIRS) recorded an average of 4,069 vehicle fires per year, which is approximately 5.5% of the average fire calls in any one jurisdiction in the state.

The goal of this emergency response program is to provide you, the emergency responder, with background information about NGVs so that you can make informed decisions at the scene of an NGV emergency. This background information should be integrated with your own department's Standard Operating Guidelines for incident management, scene safety, auto extrication, and rescue.

Origins of Natural Gas

Natural gas is primarily methane (CH_4). It originates through conversion of organic material by micro-organisms (biogenesis), thermal decomposition of buried organic matter (thermogenesis), or deep crustal processes (abiogenesis). When formed by thermogenesis or abiogenesis, buoyant methane migrates upward through rock pores and fractures, then either accumulates under impermeable layers or eventually reaches the surface and dissipates into the atmosphere.

- Biogenic methane results from the decomposition of organic matter by methanogens, which are methane-producing micro-organisms. Methanogens also live inside the intestines of most animals (people included and in the cud of cows and sheep, where they aid in the digestion of vegetable matter. Composts and landfills are also examples biogenic methane production.
- Thermogenic methane is formed in a manner similar to oil. As organic particles deposited in mud and other sediment become deeply buried and compressed, higher

Timeline of Natural Gas Use

1,000 B.C.

According to legend, a goat herdsman discovered a burning spring of natural gas that originated on Mount Parnassus in Greece. A temple was built on the spot and the priestess, the Oracle of Delphi, spoke of prophecies inspired by the burning spring. Burning springs of natural gas were prominent in religious practices of ancient Persia and India, where temples were constructed around these "eternal flames." The Greeks, Persians, and Indians did not recognize the energy value or potential usefulness of natural gas.

500 B.C.

The Ancient Chinese used natural gas to make potable water by piping natural gas from shallow wells through bamboo poles and burning it to heat and distill sea water.

1626

French missionaries recorded that North American Indians ignited swamp gases in the shallows of Lake Erie and in streams flowing into the lake. The American natural gas industry began in this area, now known as New York State. Early explorers also noticed natural gas seeping up from the ground in other parts of the eastern United States and along the California coast.

1785

Britain commercialized the natural gas industry, using gas manufactured from coal; not from naturally occurring natural gas. A Scotsman, William Murdock, improved upon a method of manufacturing natural gas and used it to light his home. Shortly afterwards, the first natural gas company illuminated London streets with gaslights.

1816

Manufactured natural gas arrived in the United States when the city of Baltimore, Maryland, installed gaslights. Baltimore's gas was also manufactured from coal. This gas had a much lower energy content and more impurities than today's natural gas.

1821

The birthplace of underground natural gas in America is Fredonia, New York, a small village on the Candaway Creek near Lake Erie. Fredonia residents observed gas bubbles rising to the surface from a creek. William Hart dug the first natural gas well in America along a creek outside Fredonia. The well was approximately 27 feet deep (By contrast, today's wells are over 30,000 feet deep). As the first person to put natural gas to work in America, he is considered America's "father of natural gas." Other individuals expanded upon his work, and a group of entrepreneurs formed the Fredonia Gas Light Company, our nation's first natural gas company. Natural gas drilling continued throughout western New York, Pennsylvania, northern Ohio, and northern Indiana.

1900's

Natural gas was discovered in 17 states. Dr. Karl Von Linde, a German scientist, invented a way to separate air by cooling it in stages until the various constituents (oxygen, carbon dioxide) condensed to a liquid. Using Von Linde's technique, Godfrey Cabot applied for a U.S. patent to liquefy natural gas. By condensing the gas to a liquid, he could solve storage and transportation problems. Pipelines were developed to transport LNG.

1920's

Natural gas continued to compete with manufactured gas aggressively. Plants that manufactured gas from coal were usually located in prominent cities, where there was a large and steady demand. During this time, manufactured gas had a competitive advantage due to coal's established distribution system.

1930's

Utility companies began liquefying gas as a way to stockpile it.

1950's

Interstate pipelines reached across the entire continent to provide competitive, naturally occurring natural gas, while the previously dominant manufactured gas industry declined. America's interstate pipeline system now contains over one million miles of pipe that deliver large quantities of clean, efficient and cost-effective natural gas.

temperatures cause carbon bonds in organic compounds to break down and form oil with minor amounts of gas. At increased temperatures (caused by increased burial depth), methane becomes the dominant product until it eventually replaces oil altogether. The simultaneous formation of both oil and gas in the early stage of the thermal decomposition process is the principal reason for the association of oil and gas in accumulations present in the upper one to two miles of the Earth's crust.

- Abiongenic methane is formed by another process that involves nonorganic carbon- and hydrogen-rich gases, which exist deep within the Earth. They form as either primordial gases that seep from our planet's interior or as gases liberated from crustal rocks during metamorphism. As these gases migrate upward and interact with crustal minerals, they react to form the elements and compounds present in the atmosphere (nitrogen, oxygen, carbon dioxide, argon, methane and water).

II. Natural Gas Vehicles

Today, emergency responders can expect to encounter a wide range of vehicle types that use natural gas as their primary or secondary fuel source; passenger vehicles, mass transit vehicles, refuse disposal vehicles, and freight vehicles.

- Light Duty Vehicles include: Ford F150, GMC Sierra and Chevy Silverado Pick-up trucks; Chevy Cavalier, Ford Crown Victoria, and Honda Civic; along with a variety of service vans and trucks.

- Medium and heavy duty vehicles include: refuse haulers, street sweepers, Blue Bird school buses, transit buses, transit shuttles, trolleys, Isuzu service vans; large vans and trucks manufactured by Freightliner, and Mack.

- Manufacturers include: Daimler Chrysler, Ford, General Motors, Isuzu, Honda, Toyota, Blue Bird, Mack, and Freightliner.

- Engine makers include: Caterpillar, Cummins, Detroit Diesel, and John Deere Power Systems.

In the transition from gasoline or diesel fuel, many of these vehicles may contain both gasoline tanks and natural gas cylinders that can be easily switched at the discretion of the vehicle operator. In either case—bi-fuel or all natural gas—the emergency responder must first identify the vehicles fuel system before committing to a specific fire or rescue operation.

Vehicle Identification

Many production NGVs are modifications of the same make and model (gasoline or diesel) vehicles that you see on the road every day. So how do you distinguish NGVs involved in an incident from their standard fuel counterparts? When an NGV is delivered to the customer, it comes equipped with a distinctive diamond shaped insignia with “CNG” or “LNG” printed in the middle. These decals are typically located on the rear or side/rear of the vehicle and on exposed cylinders.

These natural gas industry approved symbols were designed to aid emergency response personnel by identifying the type of fuel being used. However, you should recognize that there is no guarantee the customer will keep the insignia on the vehicle or that the insignia will be easily identified after a vehicle collision or fire.

Vehicle Operation

Natural gas vehicles, both CNG and LNG, operate much as their gasoline and diesel fuel counterparts. An ignition key is used to turn on the engine and allow the fuel to flow from the CNG cylinder or LNG container to the fuel regulator and on to the combustion engine. The fuel regulator reduces the fuel pressure on CNG vehicles from 3,600 psi to a range of 60 to 120 psi, depending on make and model of the vehicle. For LNG vehicles, the fuel is regulated from 230 psi to a range of 75 to 120 psi.

The fuel regulator regulates the pressure delivered to the engine. The fuel regulator can be located close to the CNG cylinder or LNG container, or it can be located within the engine compartment. If the regulator is near the fuel tank, downstream natural gas will be at relatively low pressures. If the regulator is near the engine, pressures from the tank to the regulator will be relatively high. The fuel flows from the cylinder or container to the regulator — then to the engine compartment and engine. Fuel is routed from the cylinder through stainless steel tubing and high-pressure fittings either under or through the vehicle chassis. In no case do the stainless steel fuel lines transverse the posts, roof or passenger compartment of the vehicle. Realizing that high-pressure fuel lines are present, exercise caution during extrication emergencies to ensure that the fuel lines are not inadvertently severed.

Vehicle Shut-Down

To shut down an NGV, you turn the ignition key to the “off” position, which simultaneously turns off the engine and stops the flow of fuel from the cylinder. NGVs have a manual shut-off valve at the cylinder or container. To insure that a CNG or LNG cylinder or container is no longer flowing fuel, or to stop a fuel leak, locate the cylinder or container shut-off valve under the vehicle chassis or close to the fuel cylinder. The shut-off valve requires a quarter turn to shut off the flow of fuel from the cylinder. The location of the fuel shut-off valve can vary from make and model of vehicle. Typically, it is near and under the cylinder itself.

III. Characteristics of Natural Gas

Natural gas is compressed so that it can be used as a practical and portable fuel supply. CNG is comprised mostly of methane with 5 to 20 percent of other vapors such as ethane, propane, and butane. A methane molecule is comprised of four hydrogen and one carbon atom and is considered a "simple" hydrocarbon (CH_4). Comparatively, gasoline and diesel are considered "complex" hydrocarbons.

Compressed Natural Gas

CNG is naturally colorless and odorless. To aid in detection of gas leaks, producers add an odorant, mercaptan, which smells like sulfur or rotten eggs. This smell can be detected before the gas reaches its lower flammability limits. Natural gas is non-toxic and presents no exposure hazard. However, natural gas can displace the atmosphere and can pose an asphyxiation hazard in enclosed spaces. Fortunately, natural gas can be ventilated to the outside and dispersed into the atmosphere.

Natural Gas has no odor, mercaptan is added to compressed natural gas to aid in detection, but is not added to liquefied natural gas.

CNG is stored under high pressure, and its storage cylinders are thicker than other types of fuel tanks. If a high-pressure fuel system component fails, gas can be released suddenly and forcefully. CNG systems are commonly pressurized up to 3600 psi—almost 30 times the pressure in an air-brake system. This is similar to the pressure of a self-contained breathing apparatus (SCBA).

Natural gas is lighter than air and will rise if released into the atmosphere. Vapors from gasoline, diesel, methanol, or propane, on the other hand, are heavier than air and tend to settle in low lying areas. The buoyancy of natural gas provides emergency responders with the option of allowing the gas to release itself to the atmosphere without harm to the environment, or of allowing a gas-fueled fire to burn itself out.

Natural Gas is lighter than air, produces a visible flame, has a flammable range of 5-15 percent, and requires very little energy to ignite it.

All fuels are flammable when vaporized and mixed with air. When CNG is released to the atmosphere, it is already in vapor form. When ignited, CNG produces a flame that is visible under most conditions. Under certain conditions, as in an unventilated confined area, CNG can also explode.

To be a fire or explosion hazard the air/fuel vapor ratio must be within the flammable range. For natural gas, the flammable range occurs when the fuel/air mixture is between 5 and 15 percent. Below 5 percent, the fuel/air mixture is too lean to burn; above 15 percent the fuel/air mixture is too rich to burn.

As a safety measure, many CNG installations have combustible gas detectors located on the ceiling — in some cases in the fuel compartment of the vehicle — to detect gas rising from a leak. These detectors sound an alarm when the mixture reaches one-fifth of the lower flammability limit.

Liquefied Natural Gas

The characteristics of LNG are similar to those of CNG. The difference is that LNG is stored as a liquid under pressure at low temperature in a cryogenic storage tank. Unlike CNG, odorant is not added to LNG. Therefore you cannot rely on the characteristic smell ("rotten eggs") of natural gas to detect a leak.

As a cryogenic liquid, LNG will burn or cause frostbite on exposed skin. Just as natural gas is lighter than air, LNG is lighter than water. LNG will form ice crystals on water and float on the surface.

Between –260 to –160 degrees (F) LNG is heavier than air, at –160 degrees LNG is the same weight as air, and lighter than air when it warms to above -160 degrees (F).

LNG vapors are lighter than air— but only after it warms to above –160 degrees (F). At –160 degrees (F) the vapor is the same weight as air. From –260 to –160 degrees (F) the vapor cloud is heavier than air.

Any gas when cooled or sufficiently compressed becomes a liquid. Steam, for example, turns to water below 212 degrees (F) under standard pressure. Methane, on the other hand, turns to liquid at –258 degrees (F).

The advantages of storing natural gas as a liquid include:

- Lower level of impurities, which in turn provides a more consistent and controlled mixture of gas to air in the engine.
- Lower storage pressure. LNG tanks are stored at 230 psi, rather than the 3,600 psi used for compressed natural gas.
- Greater storage density. LNG holds 2-3 times more than CNG.

LNG is stored in a double walled, stainless steel tank, much like a thermos. It is possible to store at least three times as much natural gas in the same volume of space as compressed gas. LNG cylinders have been subjected to the same rigorous safety tests that CNG cylinders undergo, including burn, crash, and gunshot tests and perform as well. LNG cylinders are built to DOT4L specifications according to NFPA 57.

Should a failure occur in both walls of a LNG tank, so that LNG flows out, it will pool as a liquid and form a vapor cloud that will dissipate into the atmosphere. A small leak or dribble from a refueling operation gives the liquefied natural gas a liquid mercury like character with silver beads of natural gas dancing around the pavement until they quickly dissipate into the atmosphere.

Because of the physical differences between LNG and liquefied petroleum gas (Propane or LPG), along with the differences in storage techniques, Boiling Liquid Expanding Vapor Explosion (BLEVEs) are less of a concern for LNG storage cylinders. There have been no recorded cases of catastrophic failure, or of BLEVE's associated with natural gas.

Water should not be sprayed on a liquefied natural gas spill. The reaction of water to the cryogenic liquid could cause the liquid to splatter violently over a wide area. When water is applied, it warms the liquid, increasing the amount of vapor production.

When water is applied to a LNG fire the increase in vapor volume increases the intensity of the fire. If the fuel cannot be allowed to safely burn itself off then a high flow Purple K fire extinguisher should be used. High expansion foam can be used to cover the surface of a LNG fire to reduce the intensity of the fire.

Every effort should be made to insure that the cryogenic liquid is not allowed to flow into storm or sewer drains. You can contain the liquid with an earth or sand berm.

IV. Fuel Cylindersand Refueling Facilities

CNG cylinders are similar in designand construction to the air tanks used in SCBA. However, instead of pressurized air, CNG cylinders contain pressurized natural gas.

The high-pressure gas exerts forces on the walls of the cylinders. To withstand these forces, cylinders are made of thick-walled, high strength materials such as steel, aluminum, or composites.

Cylinders are made to withstand much higher pressures than the normal service pressure. For example, a cylinder rated for service at 3,600 psi is designed to withstand pressures in excess of 8,100 psi. Regardless of this design potential, cylinders should never be pressurized above their maximum fill pressure (generally, 1.25 times the service pressure).

The typical CNG cylinder has a cylindrical-shaped sidewall with hemispherical domes on the ends. The cylinder ends typically contain a metal port that can be used for inserting a valve, end plug, or other part.

The expected life span of a cylinder is normally 15-20 years.

The four types of CNG cylinders are:

Type 1: An all metal cylinder made of steel or aluminum.

Type 2: A cylinder with a metal liner made of steel or aluminum and a hoop-wrapped fiber overwrap.

Type 3: A cylinder with a thin metal liner and fully wound-fiber overwrap.

Type 4: A cylinder with a plastic liner and a fully wound-fiber overwrap.

In composite-wrapped cylinders, the composite fiber overwrap plays a key role in resisting the high gas pressure forces pushing against the cylinder liner wall. As gas pressure increases, it produces tension on the fibers and causes them to stretch slightly. Fibers can easily handle normal gas pressure. However, going beyond the maximum fill pressure may put too much stress on the fibers leading to fiber breakage and possible cylinder failure.

Type 1 cylinders are the most widely used worldwide, and typically are made of low-alloy steel due to steel's low cost and durability. All-aluminum cylinders are also used to store CNG. In NGVs operated in the US, one is more likely to find lighter weight Type 2,3, or 4 cylinders.

There has been one reported failure of a 2400 psi cylinder in a pickup truck in LaPorte, Indiana, which exploded in 2000. Fortunately, there were no injuries. This failure is believed to have been caused by over pressurization due to failures in valves at the dispensing facility. Otherwise, there have been no other reported failures of all-metal NGV cylinders in the U.S., However, failures have been reported in Italy, Canada, and Argentina due to fires or manufacturing problems.

Type 2 cylinders consist of a metal liner and composite fiber overwrap. The cylinder is also commonly called hooped-wrapped because the composite fiber wrap is wound only around the cylinder sidewall, in the manner of barrel hoops. These cylinders are designed so that the liner, without the wrap, can contain the maximum fill pressure (1.25 times the service pressure).

There have been two reported failures of the Type 2 cylinders in the U.S. Both were aluminum Type 2 designs and were mainly due to gross degradation of the composite wrap combined with over-pressurization of the cylinder.

Type 3 cylinders consist of a thin metal liner wrapped with fiber (fiberglass, carbon or Kevlar) over the entire sidewall and dome ends. In these cylinders, the majority of the containment strength is provided by the fiber overwrap, with the primary purpose of the liner to contain the gas. These types of cylinders have a long service record as a SCBA for firefighters, and have been used in CNG vehicle service since 1971.

There have been four reported failures of Type 3 fiberglass wrapped cylinders in the U.S. stress, corrosion, or cracking of the glass fibers are known or suspected as the primary cause.

Type 4 cylinders consist of a plastic liner wrapped with composite fiber over the entire sidewall and dome ends. In these cylinders, the gas pressure load is carried by the fibers. The plastic liner is used solely as a gas barrier. These cylinders have been used in CNG vehicle service since 1991.

There has been one catastrophic failure of a Type 4 cylinder, probably due to impact damage. There have also been cases of leaking Type 4 cylinders due to cracked plastic liners.

For safety, the CNG cylinders are equipped with pressure relief devises (PRD). The devise is set at a predetermined temperature which will vent the CNG before any chance of explosion. On most vehicles a vent tube is attached to the PRD which will vent pressurized gas to the outside of the vehicle. When a cylinder is involved in a vehicle fire the compressed gas will expand and the heat of the fire will open the PRD and allow the cylinder to vent. The cylinder will continue to vent until all of the gas is expelled. For LNG containers, the PRD will vent-off excess pressure then the PRD will re-seat itself. It is important to not fill the LNG vent tube with water as the escaping gas will freeze, blocking the vent tube.

Cylinder Sensitivity

Despite rare and isolated failure incidents, the natural gas cylinders overall have had a remarkable safety record. The success of natural gas cylinders is a result of rigorous safety standards and tests. However, each type of cylinder, depending on its specific construction material, is susceptible to physical and environmental damage, as outlined below.

Steel – Type 1 and 2 cylinders may experience corrosion or impact damage on exposed surfaces of the metal cylinder.

Aluminum – Aluminum cylinders may experience galvanic corrosion if in contact with other metals, such as steel brackets.

Fiberglass – Type 2, 3, and 4 cylinders are all sensitive to physical damage such as cuts, abrasions, and impact. Older fiberglass cylinders can be damaged by strong acids (such as battery acid) and caustics. Newer fiberglass-wrapped cylinders have a protective coating or use a fiberglass which is resistant to these environmental factors.

Carbon – Type 2, 3, and 4 are all sensitive to physical damage such as cuts, abrasions, and impact from road debris and collision.

Cylinder Standards

A number of standards have been developed for natural gas cylinders, including NGV2 Standard, (ANSI/CSA NGV2 "Basic Requirements for Compressed Natural Gas Vehicle Fuel Containers"). This is a voluntary industry standard which contains ten design qualification tests, including pressure cycle, environmental pressure, burst, impact, bonfire, and gunshot.

The FMVSS 304 standard (49 CFR 571.304 – "Compressed Natural Gas Fuel Container Integrity") is a mandatory Federal (NHTSA/DOT) Motor Vehicle Safety Standard applicable to all CNG cylinders sold for motor vehicles in the US. FMVSS is similar to an older version of NGV2 but has fewer design qualification tests. Transport Canada and the International Organization for Standardization (ISO) have cylinder standards similar to NGV2.

For the fire service, NFPA 52 "Compressed Natural Gas CNG Vehicular Fuel Systems," along with FMVSS 303, ensure that pressurized CNG fuel tanks are shielded from damage by road hazards and mounted to minimize damage from a collision. To this end, fuel tanks cannot be mounted in front of the front axle or behind the rear axle. The tanks must be securely fastened to the vehicle and shielded from direct heat generated by the vehicle exhaust system. Pressure relief devices (PRD) must be vented to the outside of the vehicle.

The pressure relief device releases gas when the cylinder is exposed to a fire, to insure that the cylinder will not explode. It can also release pressure when the tank pressure increases beyond its rated capacity. The vent tube can be located at the rear or the side (rear) of the vehicle, depending on manufacturer. It is important for emergency response personnel to identify the location of the relief device vent before they begin any operation around the vehicle. When PRDs operate they vent the entire contents of the cylinder(s) they are protecting. When a PRD operates you may hear a loud, high-pitched whistle.

Vehicle Refueling

Natural gas is delivered to the refueling site from an intricate network of transmission and distribution pipelines that crisscross the country. Typically, distribution or feeder lines

Natural gas is piped to CNG refueling stations and trucked to LNG refueling stations.

deliver product to site at, or below, 60 psi. Pressure in the transmission pipeline runs 60 psi or greater.

Natural gas is then run through several stages before it is delivered to the customer. From the feeder line the gas is sent through a dryer to remove moisture and then through a filter to remove particulate matter. The natural gas is then compressed to 3,600 psi and stored in above ground storage tanks. The storage tanks can hold 10,000 cubic feet or 300 gallons of product.

The refueling customer typically has a plastic card that unlocks and provides access to the natural gas dispenser. The customer then attaches the hose to the vehicle and begins the refueling operation. Once fuel has been transferred the dispenser automatically stops the flow of fuel.

The NFPA Standards for natural gas fuel systems include:

- NFPA 52, "Compressed Natural Gas (CNG) Vehicular Fuel Systems Code"
- NFPA 57, "Liquefied Natural Gas (LNG) Vehicular Fuel Systems Code"

Each of these standards specifies that refueling stations have manual and automatic shut-off valves. A number of methods are designed to shut off the flow of natural gas:

1. A manual shut-off switch is located at the main CNG dispensing location. Customers are trained to shut down the dispenser if they feel a problem or hazard exists. If the dispenser detects a problem it will automatically shut down.
2. Breakaway protection is provided in the event of a vehicle pulling away from the refueling station while the fueling hose is still connected to the vehicle. The breakaway device stops the flow of natural gas to the dispenser.
3. A manual emergency shut-down switch is located at a remote location from the dispenser. The location is clearly marked with a red sign and white lettering. The emergency switch will stop the flow of fuel to the dispenser.
4. For emergency response personnel, a curbside shut-off valve is provided. The emergency shut-off valve will turn off the gas supply to the dispenser. It is important that emergency response personnel identify and locate the curbside valve before responding to an emergency at the facility.
5. Another emergency shut-off switch is located on the compressor control panel. Typically a trained gas company employee would use this switch and any of the valves located in the compressor and storage area while performing maintenance. The switch shuts down power and the flow of gas to the compressor.

When pre-planning a natural gas fueling station, be sure to review the gas company's EPA mandated MSDS sheets (See Appendix A) and emergency action plan. These documents specify the locations of the main electrical power as well as emergency shutoff valves and switches. Preplans of the fueling facility should

Review the refueling or maintenance station MSDS and emergency action plan while conducting a pre-plan of the facility.

include the location of fuel storage areas, compressors, along with manual, curbside and emergency shut-off valves and switches.

Emergency response to refueling stations must include the use of full structural firefighting clothing and SCBAs. You can protect and extinguish a fire involving a vehicle or threatening exposures using water and foam. If the venting CNG is on fire and it doesn't threaten lives or exposures you can let the fire continue to burn until a gas company employee arrives to lend assistance. With LNG facility fires you could also allow the fuel to burn off. You should not put water on a LNG fuel leak. If the area around above ground fueling containers are involved in a fire, and if there is no liquefied natural gas, carefully approach the tanks and use water to cool the tanks and/or to protect surrounding exposures.

CNG Residential Refueling

Though not yet common, several companies are marketing compressors that take the natural gas piped to a residential site and compress it to refuel a CNG vehicle. The residential fueling facility (RFF or vehicle refueling appliance – VRA) is an assembly used for compression and delivery of natural gas into vehicles. The RFF

includes all associated equipment such as hoses and couplings. Similar to commercial refueling stations, RFF systems have manual and automatic safeguards that shutoff both the flow of fuel and electrical power as mandated by NFPA 52.

All related equipment for an RFF is designed to minimize the possibility of physical damage and vandalism. The systems can be allowed either indoors or outdoors, but outdoor installation is preferable. With indoor installations, a gas detector set to alarm at one fifth the flammable limit is required, and the compression unit must be located to allow venting to the outdoors.

The ability for homeowners to fuel their vehicles in their private garages suggests that emergency responders should be prepared to deal with natural gas emergencies not only on the highway, but at commercial refueling stations and in residential settings. To find out if you have residential refueling in your jurisdiction, contact the local building department and ask for any codes or ordinances that allow such devices. Also, inquire about recently issued permits and the location of residences that have installed RFF systems.

LNG Containers and Refueling

LNG relies on tanker trucks to get the fuel to the refueling station. A tanker truck has the capacity of delivering up to 10,000 gallons per load. It is estimated that at least 200,000,000 gallons of LNG are trucked into California every day. And, every year this capacity keeps increasing.

The delivery truck transfers the LNG to an on-site storage tank or vehicle for mobile refueling operations. Refueling operators wear rubber aprons, work boots, leather welding gloves, safety glasses and face shields to protect themselves from the cryogenic liquid. Fuel is transferred from the storage tank to the vehicle through a vapor shielded dispenser. An emergency shut-off switch is located in the dispenser panel and at a safe remote location between 30 and 75 feet away.

Cryogenic LNG containers consists of two nested tanks that form a thermos-like insulating vessel to keep the liquid from reaching its boiling point at the designed storage pressure. The space between the inner and outer tank is vacuum sealed and filled with an insulating material to keep the liquid below its boiling point. After LNG flows from the tank, it is heated by a heat exchanger to form vapor, which is then regulated to the proper pressure before it enters the engine.

Large vehicles with sidesaddle tanks can hold up to 170 to 180 gallons of LNG. If opened to the atmosphere this volume of LNG would quickly dissipate into the atmosphere often times before emergency response personnel can get to the scene. It is common to see ice frost or ice crystals on the outside of the container

valve and hoses. Ice or frost on the container, however, would indicate a container failure. A slight loss in vacuum pressure would be indicated by sweat forming on the exterior of the tank. In either case, the LNG vapor would begin to boil off and the pressure relief valve would expel excess natural gas to the atmosphere. It is important to note that LNG pressure relief devices will re-seat after pressure is suf-ficiently lowered.

Importantly, vapor clouds around a LNG vehicle does not always indicate a leak or a problem. When dealing with a cryogenic liquid, it should be recognized that one cannot see natural gas vapors. The vapors that are visible will be the moisture in the air as it is cooled by the cryogenic fluid or metal cylinders, valves, and lines that contains it.

In an emergency involving LNG fuel leaks the immediate area should be evacuated and the surrounding exposures should be protected with hose streams until the gas completely vents to the atmosphere. You can use hose streams to direct the dispersal of the vapors away from exposures. If the vapor catches on fire protect exposures with hose streams and let the vapors burn off. If it is necessary to extinguish the fire, do not use water! Instead use a high flow Purple K extinguishing agent.

Natural Gas Cylinder and Container Location

Depending the on the make, model, and manufacturer, natural gas containers may be found in the rear, trunk, pick-up bed, as side tanks, or on top of the vehicle. In passenger vehicles and small trucks, the CNG cylinders are typically found in the rear of the vehicle, mounted in the pickup bed, the vehicle trunk, or under the rear of the vehicle where a gasoline tank had previously been mounted. Large heavy duty vehicles may replace their saddle-mount diesel tanks with LNG containers, while buses may have LNG containers under the passenger compartment or CNG cylinders on top of the vehicle.

V. Emergency Response Guide-Lines

As a flammable gas, CNG leaks and fires can occur during fueling, main tenance, repair or as a result of traffic collisions. Open flames will cause CNG to ignite, which disallows smoking, welding, grinding or any other open flame operations around CNG facilities or vehicles. CNG also can be ignited by sparks from electrical equipment, static electricity, and contact with hot surfaces. CNG fires can be fought using foam or water. However, water should not be used when fighting LNG fires. One recommended strategy when dealing with NGV emergencies is to allow the gas vapors to dissipate into the atmosphere or to burn off all the fuel when no lives or exposures are threatened.

Key emergency response guidelines:

1. Require that emergency response personnel to wear full structural firefighting clothing as well as SCBA.
2. Employ a fog pattern hose stream or charged hand line when approaching all vehicle emergencies.
3. Avoid cutting into or around fuel lines or tank storage areas of the vehicle.
4. Isolate the fuel by turning the manual shutoff valve.

Dangers of Natural Gas Leaks

A leak from the high-pressure side of a CNG fuel system could produce a high-velocity cold gas jet. As the jet travels, the concentration of the gas drops as it mixes with ambient air. A release could cause injury from flying debris, the high jet momentum, or exposure to the extremely cold gas near the release point. The high velocity jet can create high intensity noise alerting emergency response personnel to a gas leak problem and/or its location.

If the gas jet comes in contact with a spark, a jet fire or "torch fire" at very high temperatures can cause serious burns and structural damage. Remember, however, that the gas-to-air mixture has to be within the 5 to 15 percent range for ignition to take place. The ideal response to a natural gas leak is to isolate potential sources of ignition from coming into contact with the gas plume until it is safely dissipated into the atmosphere. With a torch fire protect surrounding exposures from radiant heat or direct flame impingement with fog streams allowing the torch fire to burn itself out.

CNG is always odorized. You can usually detect a CNG leak by the characteristic smell of natural gas long before there is a flammable mixture. LNG is generally odorless! Therefore you cannot rely on the characteristic smell of natural gas to detect an LNG leak.

The greatest danger for natural gas is in enclosed spaces. Natural gas can displace oxygen in the atmosphere making it a potential asphxyiant hazard. In enclosed spaces, and in the proper flammable range, natural gas can explode when in contact with an ignition source.

CNG & LNG Emergency Response

Emergency response to CNG and LNG can be pre-determined with the following actions:

1. Use gas detectors to determine a leak in the fuel system.
2. Isolate the fuel from potential sources. This can be accomplished by shutting-off the fuel valves on the vehicle or at the

refueling station, or by directing the vapor cloud away from buildings and other potential sources of ignition with a fog stream.

3. If the fuel is on fire, protect surrounding exposures with hose streams and allow the fuel to burn it self off.
4. Use foam or water to extinguish a CNG fire if necessary.
5. Use a high volume of Purple K to extinguish a LNG fire, being careful of flashback after the fire has been extinguished.
6. Use high expansion foam on the surface of a LNG fire to reduce the fire's intensity.
7. Avoid contact with the high velocity jet in a CNG Leak
8. Avoid contact with LNG liquid.
9. Use sand or dirt to create a berm around a LNG fuel leak making sure that the fuel doesn't flow into sewer or storm drains.

Emergency Medical Considerations

LNG will cause first degree burns or frostbite if not treated immediately. If a person has LNG on their clothes, defrost the fabric with water before trying to remove the clothing. Otherwise, frozen fabric will adhere to the skin—increasing the damage to the injured area.

CNG & LNG Emergency Response Scenarios

By understanding the characteristics of natural gas and NGV technology, you can extrapolate ways to respond to a variety of vehicle emergencies. The technical knowledge you have gained from reading this document should be integrated with your department's standard operating procedures for incident command, scene management, and extrication or rescue.

Note again that in every NGV event, emergency response personnel should wear complete protective gear including: turn-out jacket and pants, boots, gloves, helmet, and SCBA. Charged hose lines and fog patterns should be used on initial approach.

Case 1: In an emergency response involving a CNG vehicle where there is no fire and no apparent escape of gas:

Objective: To secure the vehicle and provide care to vehicle occupants.

1. Identify vehicle and fuel type.
2. Approach vehicle upwind and at a 45 degree angle.
3. Shut-off ignition switch by turning the ignition key to the "off" position.
4. Isolate fuel by turning off the emergency shut-off valve at the cylinder.

Case 2: In an emergency response involving a CNG vehicle where there is no fire but an obvious gas release:

Objective: To mitigate the effects of escaping gas and provide care to vehicle occupants.

1. Identify vehicle and fuel type.
2. Evacuate the immediate area.
3. Approach vehicle upwind and at a 45 degree angle.
4. Protect surrounding exposures and rescue personnel with charged hose lines.
5. Shut-off ignition switch by turning the ignition key to the "off" position.
6. Isolate fuel by turning off the emergency shut-off valve at the cylinder.
7. Allow gas to expel until dissipated.

Case 3: In a response to an interior CNG vehicle fire which does not involve the gas or tanks:

Objective: To keep the fire from extending to the fuel tanks and to protect exposures and rescue personnel.

1. Identify vehicle and fuel type.
2. Evacuate the immediate area.
3. Approach vehicle upwind and at a 45 degree angle.
4. Extinguish fire with water and/or foam.
5. Isolate fuel by turning off the emergency shut-off valve at the cylinder.

Case 4: In a response to an LNG engine compartment fire:

Objective: To keep the fire from extending to the rest of the vehicle and fuel containers.

1. Identify fuel type.
2. Use hose lines to protect exposures and rescue personnel.
3. Approach vehicle upwind and at a 45 degree angle.
4. Shut-off fuel valve at the storage container.
5. Protect exposures from ignition with hose lines.
6. Extinguish the engine compartment fire.

Case 5: In a response to a vehicle fire that involves a fire fed by venting natural gas:

Objective: To protect surrounding exposures and to burn all the natural gas fuel from the CNG cylinder.

1. Evacuate the area.
2. Protect surrounding exposures.
3. Use hose lines to protect and cool vehicle exterior without extinguishing the fire.
4. Let the fire burn till fuel is exhausted.

Case 6: In a response to a CNG vehicle fire at a refueling station:

Objective: To secure the facility before firefighting operations begin.

1. Evacuate surrounding area.
2. Use curbside valve to shut-off the flow of fuel to the dispenser.
3. Extinguish the vehicle fire with water and/or foam.

Case 7: In a response involving a LNG vehicle where there is no fire.

Objective: To secure vehicle and assist vehicle occupants.

1. Approach the vehicle up-wind and at a 45 degree angle.
2. Check to ensure that there is no gas leak and that the container is not damaged.
3. Turn shut-off valve to close the cylinder.
4. Assist vehicle occupants.

Case 8: In a response involving an LNG vehicle, where ice and frost is visible on the outside tank.

Objective: To secure the scene of the emergency.

1. Evacuate the surrounding area.
2. Allow the gas to vent until dissipated and protect exposures with hose lines.

Case 9: In a response involving an LNG vehicle or refueling station in which there is LNG on the pavement:

Objective: To secure the scene and allow the gas to dissipate without catching fire.

1. Do not add water to liquid natural gas spills! Water spray can cause LNG to violently splatter, increasing the fire danger.
2. Evacuate surrounding area.
3. Allow the natural gas to vaporize and dissipate into the atmosphere.

Case 10: In a response to a fire involving an LNG refueling station:

Objective: To secure the scene and allow the gas to burn off.

1. Evacuate surrounding area.
2. Protect exposures from radiant heat with hose streams.
3. Allow the gas to burn itself out

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APPENDIX A

Liquefied Natural Gas MSDS Sheet

1. CHEMICAL PRODUCT and COMPANY INFORMATION

EL PASO ENERGY
1001 LOUISIANA
HOUSTON, TEXAS 77002

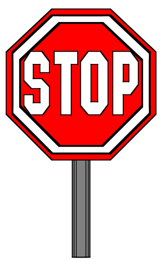
NFPA HAZARD RATING

HEALTH:	1
FIRE:	4
REACTIVITY:	0
OTHER:	-

EMERGENCY TELEPHONE: **INFOTRAC (800) 535-5053** (24 HOURS)

CHEMICAL FAMILY Complex mixture of petroleum hydrocarbons.

SYNONYMS: Dry Natural Gas, Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), Methane, Processed Gas, Sweet Natural Gas, Treated Gas.



BE SAFE! READ OUR PRODUCT SAFETY INFORMATION AND PASS IT ON! (PRODUCT LAW REQUIRES IT!)

2. COMPOSITION AND INFORMATION ON INGREDIENTS

Ingredient Name	CAS Number	OSHA PEL	ACGIH TLV	ACGIH (STEL)	Concentration (percent by weight)
Methane	**74-82-8**	**N/A***	**N/A***	**N/A***	**85 - 90**
Ethane	**74-84-0**	**N/A***	**N/A***	**N/A***	**4 - 5**
Carbon Dioxide	**124-38-9**	**5000 ppm**	**5000 ppm**	**30,000 ppm**	**1 - 5**

*** None established by OSHA or ACGIH.**

A complex mixture of light gases separated from raw natural gas consisting of aliphatic hydrocarbons having carbon numbers in the range of C1 through C4 predominately methane (C1) and ethane (C2). May be odorized with trace amounts of odorant (typically well below 0.1% t - butyl mercaptan).

EMERGENCY OVERVIEW
DANGER!

EXTREMELY FLAMMABLE GAS-MAY CAUSE FLASH FIRE OR EXPLOSION-IN HIGH CONCENTRATIONS

High concentrations my exclude oxygen and cause dizziness and suffocation. Contact with liquid or cold vapor may cause frostbite or freeze.

3. HAZARDS

PRIMARY ROUTES OF ENTRY:
Eyes: NO **Skin:** NO **Inhalation**: YES **Ingestion**: NO

EYES
Vapors are not irritating. However, contact with liquid or cold vapor may cause frostbite, freeze burns, and permanent eye damage.

SKIN
Vapors are not irritating. Direct contact to the skin or mucous membrane with liquefied product or cold vapor may cause freeze burns and frostbite. Signs of frostbite include a change in the color of skin to gray or white, possibly followed by blistering. Skin may become inflamed and painful.

INGESTION
Ingestion is unlikely. Contact of the mucous membranes with liquefied product may cause frostbite or freeze burns.

INHALATION
This product is considered to be non-toxic by inhalation. Inhalation of high concentrations may cause central nervous system depression such as dizziness, drowsiness, headache, and similar narcotic symptoms, but no long term effects. Numbness, a "chilly" feeling, and vomiting have been reported from accidental exposure to high concentrations.

This product is a simple asphyxiant. In high concentrations, it will displace oxygen from the breathing atmosphere, particularly confined spaces. Signs of asphyxiation will be noticed when oxygen is reduced to below 16%, and may occur in several stages. Symptoms may include rapid breathing and pulse rate, headache, dizziness, visual disturbances, mental confusion, incoordination, mood changes, muscular weakness, tremors, cyanosis, narcosis and numbness of the extremities. Unconsciousness leading to central nervous system injury and possibly death will occur with inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.
Warning: *The burning of any hydrocarbon as a fuel in an area without ventilation may result in hazardous level of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.*

CHRONIC and CARCINOGENICITY
None expected - see Section 11

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Individuals with pre-existing conditions of the heart, lungs, and blood may have increased susceptibility to symptoms of asphyxia.

4. FIRST AID MEASURES

EYES
In case of frostbite or freeze burns, gently soak the eyes with cool to lukewarm water. DO NOT WASH THE EYES WITH HOT WATER (i.e. over 105 degrees). Open eyelids wide to allow liquid to evaporate. If the person cannot tolerate light, protect the eyes with a bandage or handkerchief. Do not introduce ointment into the eyes without medical advice. Seek immediate medical treatment.

SKIN
Remove contaminated clothing and flush affected area with cool to lukewarm water. Rewarming the exposed area may be performed, however DO NOT USE HOT WATER. Seek immediate attention if blistering, tissue freezing, or frostbite has occurred.

INGESTION
DO NOT INDUCE VOMITING BECAUSE OF DANGER BREATHING LIQUID INTO LUNGS. Seek immediate medical attention. Rinse mouth with water. Administer 1 to 2 glasses of water or milk to drink. Never administer liquids to an unconscious person.

INHALATION
Remove person to fresh air. If the person is not breathing, give artificial respiration. If breathing is difficult, give oxygen. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT METHOD:	**Extremely Flammable gas**
AUTOIGNITION POINT;	**900-1170°F (482 -632°C)**
OSHA/NFPA FLAMMABILITY CLASS:	**Flammable gas**
LOWER EXPLOSIVE LIMIT (%):	**3.8 - 6.5**
UPPER EXPLOSIVE LIMIT (%):	**13 - 17**

FIRE AND EXPLOSION HAZARDS

Liquid releases of flammable vapors at well below ambient temperatures readily form a flammable mixture with air. Dangerous fire and explosion hazard when exposed to heat, sparks, or flame. Vapors are heavier than air and may travel long distances to a point of ignition or flashback. Container may explode in heat or fire. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

Dry chemical, carbon dioxide, halon, or water: Class C, B, or A extinguisher, respectively. However, fire should not be extinguished unless flow of gas can be immediately stopped.

FIRE FIGHTING INSTRUCTIONS

Gas fires should not be extinguished unless flow of gas can be immediately stopped. Shut off gas source and allow gas to burn out. If spill or leak has not ignited, determine if water spray may assist in dispersing gas or vapor to protect personnel attempting to stop the leak.

Use water to cool equipment, surfaces and containers exposed to fire and excessive heat. For large fire, the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure.

Isolate the area, particularly around the ends of the storage vessel. Let vessel, tank car, or container burn unless leak can be stopped. Withdraw immediately in the event of a rising sound from the venting of a safety device. Large fires typically require NIOSH/MSHA-approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY SPILL CONTINGENCY PLAN (e.g. SPCC, RCRA, OPA, or EMERGENCY plan).

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible to evaluate the direction of product travel. Vapor cloud may be white, but color will dissipate as cloud disperses - fire and explosion hazard is still present!

Stop the source of the release, if safe to do so. Do not flush down sewer or drainage systems. Do not touch spilled liquid (frostbite or freeze burn hazard!).
Consider the use of water spray to disperse vapors. Isolate the area until gas has dispersed. Ventilate and gas test area before entering.

7. HANDLING and STORAGE

HANDLING and STORAGE PRECAUTIONS

Keep away from flame, sparks, and excessive temperatures. Store only in approved containers. Bond and ground containers. Use only in well ventilated areas. See also applicable OSHA regulations for the handling of this product, including, but not limited to, 29 CFR 1910.110 Storage and Handling of Liquefied Petroleum Gases.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

ENGINEERING CONTROLS
Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces. Use explosion-proof equipment and lighting in classified/controlled areas.

EYE/FACE PROTECTION
Where there is a possibility of liquid contact, wear splash proof SAFETY goggles and faceshield.

SKIN PROTECTION
When contact with liquid may occur, wear apron, faceshield, and cold-impervious, insulating gloves.

RESPIRATORY PROTECTION
Use a NIOSH/MSHA approved positive-pressure, supplied air respirator with escape bottle or self-contained breathing apparatus (SCBA) for gas concentrations above occupational exposure limits, for potential uncontrolled release, if exposure levels are not known, or in an oxygen-deficient atmosphere.
Caution: Flammability limits (i.e., explosion hazard) should be considered when assessing the need to expose personnel to concentrations requiring respiratory protection selection.

Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE
A colorless gas. Cold vapor cloud may be white but the lack of visible gas cloud does not indicate absence of gas. A colorless liquid under pressure.

ODOR
Odorless when pure, but may have a "natural gas" type odor when treated with odorizing agent (usually t-butyl mercaptan).

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	**-259°F (-162°C)**
VAPOR PRESSURE:	**40 atm. @ -187°F (-86°C)**
VAPOR DENSITY (air = 1):	**0.6**
SPECIFIC GRAVITY (H20 = 1)	**0.4 @ -263°F (164°C)**
SOLUBILITY (H20):	**3.5%**

10. STABILITY and REACTIVITY

STABILITY: Stable

CONDITIONS TO AVOID
Keep away from ignition sources and heat, high temperatures, open flames, sparks, welding, smoking, static electricity, and other ignition sources.

INCOMPATIBLE MATERIALS
Keep away from strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide, and noncombustible hydrocarbons (smoke).

HAZARDOUS POLYMERIZATION
Will not occur.

11. TOXICOLOGICAL PROPERTIES

CHRONIC EFFECTS OF CARCINOGENICITY
OSHA: NO IARC: NO NTP: NO ACGIH: NO

12. ECOLOGICAL INFORMATION

Liquid release is only expected to cause localized, non-persistent environmental damage, such as freezing. Biodegradation of this product may occur in soil and water. Volatilization is expected to exist entirely in the vapor phase in ambient air.

13. DISPOSAL CONSIDERATIONS

Consult federal, state, and local waste regulations to determine appropriate waste characterization of material and allowable disposal methods.

14. TRANSPORTATION INFORMATION

PROPER SHIPPING NAME:	Natural Gas Compressed (with high methane content)
HAZARD CLASS:	2.1
DOT IDENTIFICATION NUMBER:	UN1971
DOT SHIPPING LABEL:	FLAMMABLE GAS

PROPER SHIPPING NAME:	Natural Gas Refrigerated Liquid (Cryogenic liquid with high methane content)
HAZARD CLASS:	2.1
DOT IDENTIFICATION NUMBER:	UN1972
DOT SHIPPING LABEL:	FLAMMABLE GAS

15. REGULATORY INFORMATION

U.S. FEDERAL REGULATORY INFORMATION
This product and it's constituents listed herein are on the EPA TSCA Inventory.

Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal reporting requirements. Consult those regulations applicable to your facility/operation.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)
The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g. SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA TITLE III - SECTION 313 SUPPLIER NOTIFICATION
SARA TITLE III - HAZARD CLASSES: ACUTE HEALTH HAZARD
CHRONIC HEALTH HAZARD
FIRE HAZARD
This product does not contain any chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 and of 40 CFR 372. **This information must be included on all MSDSs that are copied and distributed for this material.**

U.S. STATE REGULATORY INFORMATION
Any spill or controlled release of this product may be subject to state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the state and/or local level. Consult those regulations applicable to your facility/operation.

CANADIAN REGULATORY INFORMATION (WHMIS)
WHIMS: Class A (Compressed Gas)   Class B, Division 1 (Flammable Gas)

16. OTHER INFORMATION

NFPA HAZARD RATING	HEALTH:	1	Slight
	FIRE:	4	Extreme
	REACTIVITY:	0	Negligible
	OTHER: -		
HMIS HAZARD RATING	HEALTH:	1	Slight
	FIRE:	4	Severe
	REACTIVITY:	0	Minimal

Supercede: New